(12) UK Patent Application (19) GB (11) 2 088 748 A

(21) Application No 8135337
(22) Date of filing
24 Nov 1981
(30) Priority data
(31) 216510
(32) 10 Dec 1980
(33) United States of America (US)
(43) Application published
16 Jun 1982
(51) INT CL³ B05B 1/00
(52) Domestic classification
B2F 210 317 330 336 GA
(56) Documents cited
None
(58) Field of search
B2F

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(54) Replaceable nozzle for a spray gun

(57) A nozzle comprises a metal dome having an outlet orifice 77 extending therethrough, the nozzle being of metal and having a coating of low-friction plastics such as PTFE, on the outside and inside of the dome and in the edges of the orifice. The exterior end surface of the nozzle is partly spherical and of a larger radius than the semi-spherical portion of the bore. However, the centroid of the internal spherical surface is spaced forwardly of the centroid of the external spherical surface, so that the thickness of the tip decreases toward its axis, that is, toward the apex of the dome. An air cap 13 is provided for blowing air against the exterior of the dome, to clean the outer surface of the dome.

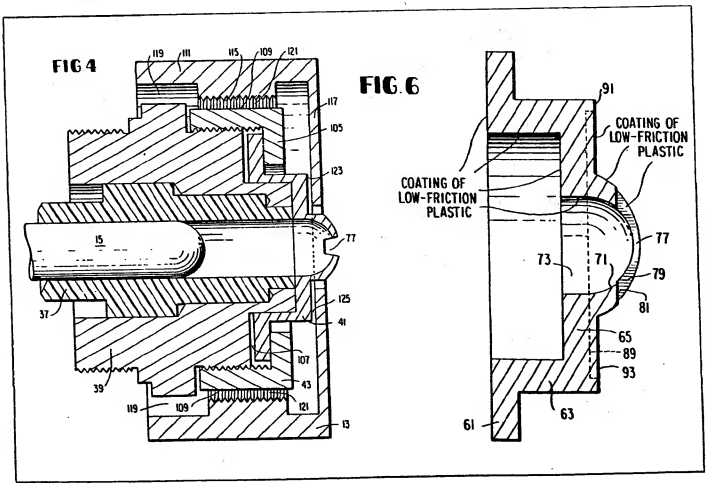

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FIG.1

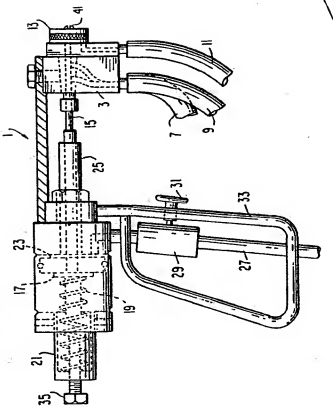
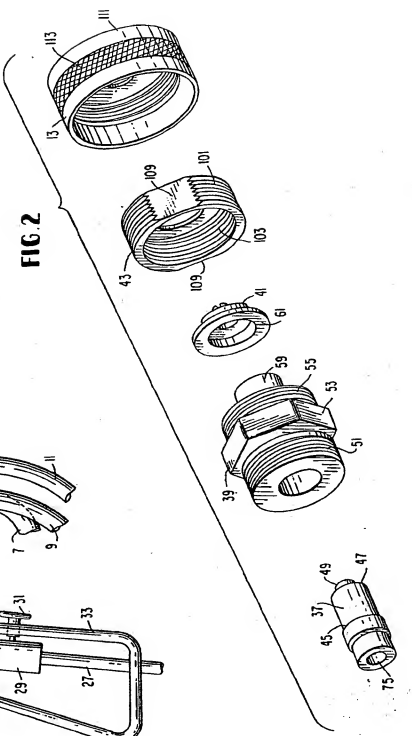


FIG.2



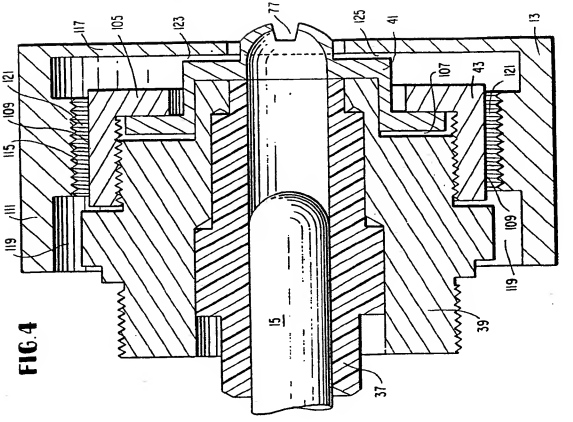


FIG.4

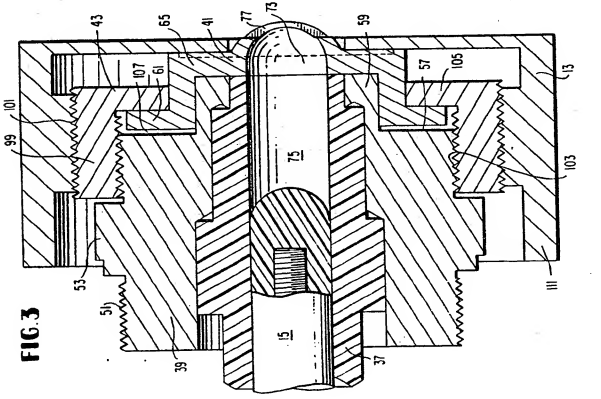


FIG.3

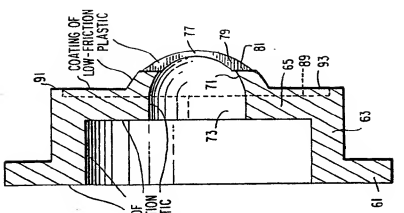


FIG.6

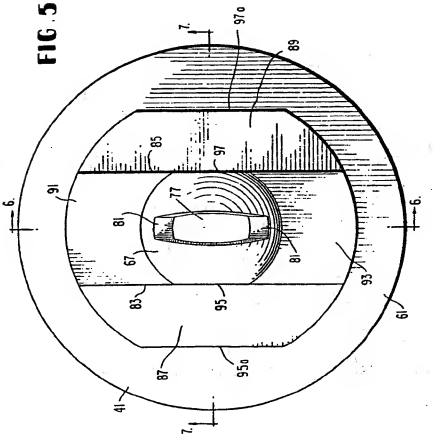


FIG.5

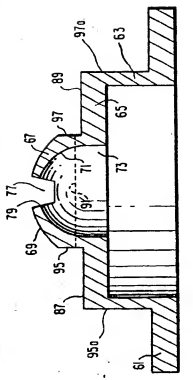


FIG.7

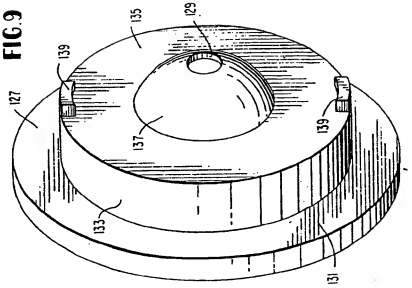


FIG.9

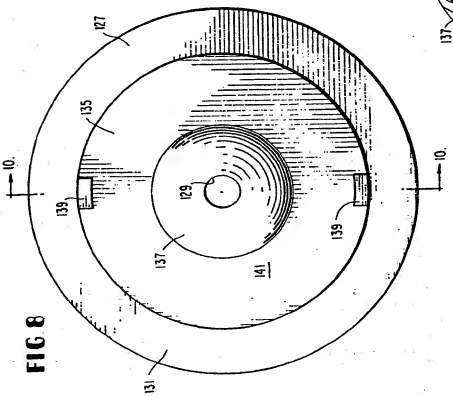


FIG 8

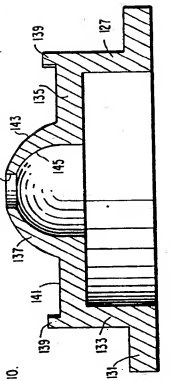


FIG.10

SPECIFICATION

Spray gun with replaceable nozzle

The present invention relates to a spray gun having a replaceable nozzle or tip from which the sprayed material emerges.

The invention will be disclosed hereinafter in connection with the spraying of mixtures of mutually reactive liquids, such as thermosetting resin formulations, which must be quickly expelled from the gun when the gun is not in use, least they set up in the gun and clog the gun. Such guns are desirably self-cleaning, and to this end may be provided with a plunger that reciprocates in the liquid passageway of the gun to expel the reactive liquid from the gun. Such guns, and representative materials with which they are used, are disclosed for example in U.S. patents Nos. 2,890,836, 3,263,928 and 3,876,145. The disclosure of these patents, particularly the last of the three, is incorporated in the present application by reference, in order to avoid prolixity of disclosure. However, it is expressly to be understood that the present invention is not limited to the spraying of reactive liquids nor to spray guns including a reciprocating plunger, but rather is also useful for the application of relatively non-reactive liquids, e.g. paint.

Indeed, the disclosure of U.S. patent No. 3,876,145 is usable in the present invention almost without change, the principal modification required being that, in the fan pattern embodiment of the present invention, the inlet liquids are not given a swirling motion in the mixing chamber, because in that embodiment it is the slot of the fan tip which shapes the spray pattern.

Such a fan tip is in fact an important embodiment of the present invention. Fan pattern spray guns are already known, and are generally characterized by an elongated outlet opening in a spray nozzle, the pattern of the spray conforming roughly to the shape of the outlet. However, fan pattern spray guns as known heretofore have suffered from a number of disadvantages. In the first place, the shape of the spray pattern produced by the gun tends to depart from the shape of the outlet opening, with the result that regardless of how accurately the outlet opening is formed, the spray pattern will nevertheless be other than desired. For example, known fan pattern spray guns have a tendency to form "fingers" at the ends of the elongated spray pattern, these fingers comprising random and undesired portions of spray that extend beyond the desired pattern in the lengthwise direction of cross section of the pattern. In the second place, difficulty has been experienced in assembling such guns , so that the slot is desirably oriented relative to the rest of the gun, with the result that the user must hold the gun in unnatural positions in order to coat the substrate to be sprayed in a direction perpendicular to the length of the spray pattern.

Moreover, the spray guns as known heretofore, no matter what the shape of the outlet orifice, have been difficult to clean, regardless of the liquid that is being sprayed; and particularly in the case of mutually reactive liquids, which must be promptly expelled from the gun to avoid clogging, great difficulty in cleaning has been experienced.

Accordingly, it is an object of the present invention to provide a spray gun having a nozzle by which the spray pattern can be accurately predetermined.

Still another object of the present invention is the provision of a spray gun having a nozzle which is easy to clean.

A further object of the present invention is the provision of a spray gun having a nozzle which is self-sealing against undesired seepage of the liquid to be sprayed.

A still further object of the present invention is the provision of a fan pattern spray gun whose structure lends itself to assembly of the parts in an accurate orientation relative to each other.

Finally, it is an object of the present invention to provide a spray gun having a spray nozzle which will be relatively simple and inexpensive to manufacture, east to assemble, operate, maintain and repair, and durable in use.

Other objects and disadvantages of the present invention will become apparent from a consideration of the following description, taken in connection with the accompanying drawings, in which:

Figure 1 is a side elevational view of a spray gun according to the present invention;

Figure 2 is an exploded perspective assembly view of the spray nozzle and components associated therewith, of the present invention;

Figure 3 is an enlarged cross-sectional view of the components of Fig. 2 in their assembled relationship, showing also an end of the valving rod;

Figure 4 is a view similar to Fig. 3, but showing the parts rotated 90° about their common axis;

Figure 5 is a front elevational view, on a still larger scale, of the fan tip which comprises a first embodiment of the spray nozzle per se of the present invention;

Figure 6 is a cross-sectional view on the line 6–6 of Fig. 5, showing the fan tip in its Fig. 3 position;

Figure 7 is a cross-sectional view on the line 7–7 of Fig. 5, showing the fan tip in its Fig. 4 position;

Figure 8 is a front elevational view of a second embodiment of spray nozzle of the invention;

Figure 9 is a perspective view of the nozzle

of Fig. 8; and

Figure 10 is a cross-sectional view taken on the line 10–10 of Fig. 8.

Referring now to the drawings in greater detail, there is shown a spray gun according to the present invention, indicated generally at 1, and incuding a head 3. Conduits 7 and 9 each supplies a different liquid to head 3. Sources of supply for these different liquids under pressure to conduits 7 and 9 are not shown but may take any usual form. An air hose 11 supplies compressed air to an air cap 13. The air cap 13 directs air against and along the exterior of the spray nozzle for the purpose of cleaning the exterior of the front end of the apparatus. For this purpose, compressed air can be used at a relatively low gauge pressure, for example, about 1 to 10 psig. In this way, the accumulation of deposits of reactive or other material about the outlet of the spray equipment is avoided. This compressed air is not intended to assist in atomizing when spraying. The operation of the air and the structure for shaping the air streams, will be discussed in greater detail hereinafter.

A plunger 15 comprising a valving rod is reciprocable in head 3. Plunger 15 adjacent its forward or free end is of cylindrical contour and of uniform external diameter except at its very end where it is semi-spherical. Adjacent its rear end, plunger 15 carries an adjustment nut 17 screw-threadedly thereon. A coil compression spring 19 bears between adjustment nut 17 and the rear end of the housing 21 carried by the gun and continuously urges plunger 15 forwardly. A piston 23 is slidable in a cylinder formed in the rear of the gun. A hollow tubular sleeve 25 extends forwardly from piston 23 and encompasses plunger 15 to guide and support plunger 15 and also to guide piston 23.

An air hose 27 under the control of valve 29 brings compressed air to the forward side of the piston 23 to force piston 23 rearwardly against adjustment nut 17 and to force adjustment nut 17 and with it plunger 15 rearwardly against the action of spring 19. Valve 29 is selectively opened and closed by actuation of an actuating button 31 carried by the handle 33 of the gun. Depressing button 31 opens valve 29 to admit compressed air 27 to the chamber forwardly of piston 23, to drive the piston rearwardly until the rear end of plunger 15 contacts an adjustable plunger stop 35 screw-threadedly received in the rear of housing 21 and rotatably adjustable to advance or retract its forward end thereby to fix the rearmost position of plunger 15. The forwardmost position of plunger 15 is set by its engagement with the interior of the spray nozzle with which it mates closely thereby to expel as much as possible of the liquid from within the bore and nozzle that are swept by plunger 15.

The particular novelty of the present invention is as follows:

Head 3 screw-threadedly carries on its forward side an assembly shown in Figs. 2–4, comprising a front packing 37, a body 39 in which packing 37 is received, a fan tip 41 which, as previously indicated, comprises a first embodiment of the spray nozzle per se of the present invention, a retainer 43 that holds fan tip 41 is place on body 39, and the previously-mentioned air cap 13.

Front packing 37 is of solid polytetrafluoroethylene or other resiliently deformable low friction plastic, of an internal diameter slightly less than the external diameter of plunger 15, so that plunger 15 slides therein with an interference fit as explained in greater detail in the above-identified patent No. 3,876,145. Packing 37 has forwardly facing annular shoulders 45 and 47 thereon, thereby properly to position packing 37 within body 39 against corresponding annular rearwardly facing shoulders of body 39, with front end 49 of packing 37 flush with the front end of body 39.

Body 39, in turn, has a rear end screw-threaded at 51 by which it is received in and secured to head 3 with the space between body 39 and air cap 13 in communication with the outlet end of an air passageway through head 3 that is supplied by air hose 11, for a purpose to be described in greater detail hereinafter.

Body 39 also has an enlarged hexagonal flange 53 for ease of assembly to and disassembly from head 3; and forwardly of flange 53 is a forward set of screw threads 55 that terminate in an annular forward surface 57 disposed in a plane perpendicular to the axis of the device. At the front end of body 39 is a cylindrical boss 59 that terminates in a flat forward surface in a plane perpendicular to its axis, that last surface being, as pointed out above, flush with front end 49 of packing 37.

The fan tip 41 which, as pointed out above, constitutes a first embodiment of the spray nozzle per se of the present invention, is of metal, preferably steel, and is comprised by a flat annular flange 61 disposed in a plane perpendicular to the axis of the device. About the inner periphery of flange 61 is forwardly extending cylindrical body 63 that terminates in generally flat annular front wall 65. The central opening of front wall 65 is surmounted by a dome 67 having an outer part-spherical surface 69 and an inner semi-spherical surface 71. The radius of surface 69 is substantially larger than that of surface 71; and the centroid of surface 69 is disposed along the axis of the device to the rear of the centroid of surface 71. As a result, dome 67 is thickest adjacent its base, that is, adjacent wall 65, and thinnest adjacent its apex on the axis of the device. Thus, the thickness of dome 67 progressively and gradually de-

creases in forward direction, for a purpose to be explained hereinafter.

It has been found that the progressive thinning of the dome toward its apex, unexpectedly improves the regularity of the fan pattern. It may be that this improves results from the overall reduction in the average thickness of the dome; however, the reasons for this desirable result are not known with precision. Moreover, it is to be noted that this progressive thinning of the side walls of the dome toward the apex is quite easy to perform by an easily reproducible machining operation, whereby what might be considered to be a structure of complex configuration, is nevertheless easy to produce with accuracy. In order to take advantage of this feature, the side walls of the dome must be thin to begin with; specifically, the inside radius of the dome is greater than the greatest thickness of the dome, and preferably several times greater.

Inner semi-spherical surface 71 is tangential to a cylindrical bore 73 of the same diameter, which constitutes the inner margin of front wall 65. Bore 73, in turn, is exactly aligned with a bore 75 of the same diameter through packing 37.

Dome 67 is transected by a slot 77 having forwardly diverging side walls 79 and flat ends 81 that are disposed in a common plane perpendicular to the axis of the device.

A portion of the material of front wall 65 is cut away on each side of dome 67, the cut-away portions being bounded on their sides by planes 83 and 85 parallel to slot 77 and to each and to the axis of the device, the remaining portions of front wall 65 being bounded forwardly by surfaces 87 and 89 disposed in a common plane perpendicular to the axis of the device. There are thus left, at each end of slot 77 and on opposite sides of dome 67, raised portions 91 and 93 whose forward surfaces are coplanar in a plane perpendicular to the axis of the device, which forward surfaces were portions of the original surface of front wall 65 before it was cut away on and parallel to opposite of the slot.

Planes 83 and 85 are chordal to dome 67, with the result that portions of dome 67 are cut away to produce flats 95 and 97, also disposed in planes 83 and 85, respectively, whose purpose will be described hereinafter.

Flats 95a and 97a are also provided on cylindrical body 63, to provide purchase for a tool by which the rotated position of the fan tip is adjusted. Flats 95a and 97a are spaced on opposite sides of and are parallel to flats 95 and 97.

Certain of the surfaces of fan tip 41 are coated with a low-friction plastic such as polyfluoroethylene, e.g. polytetrafluoroethylene known as "Teflon" (Registered Trade Mark). This coating is not shown as such in the drawings, because the coating is very thin, such as 1.5 thousands of an inch. However, the coated surfaces are indicated in the drawings. Specifically, the coated surfaces are the rear of flange 61, the inside of cylindrical body 63, the front and rear of front wall 65 and hence the surfaces indicated at 83–93, the inside and outside of dome 67 and hence the flats 95 and 97, the side walls and ends of slot 77, and bore 73. The coating can be applied by any of the conventional methods for doing so, e.g. in a fluidized bed of particles of the coating material.

The plastic coating on fan tip 41 performs a number of new and unobvious functions, some of which will now be described and others of which will be described later in connection with structure still to be discussed. For one thing, the plastic on the inside of dome 67 and bore 73 performs an anti-stick function such that the purging of the liquid from the tip under the pressure of the forward end of valving rod plunger 15 is augmented. Furthermore, the coating on the inside of the dome and bore of the fan tip, reduces the friction of the fan tip on the body of liquid being sprayed, thereby reducing its turbulence and again improving the regularity of the fan pattern. However, the use of a polytetrafluoroethylene coating on the inside of spray equipment is taught by German Offenlegungsschrift 2,252,754; and so no claim is made to this feature that broadly.

Retainer 43 holds fan tip 41 on body 39, and for this purpose is provided with a cylindrical skirt or side wall 99 which is externally screw threaded at 101 and internally screw threaded at 103 for engagement with screw threads 55 on body 39. Retainer 43 has an annular inwardly extending front flange 105 whose internal diameter is about the external diameter of cylindrical body 63 of fan tip 41, and whose rear surface contacts the forward surface of flange 61 on fan tip 41. Notice that when retainer 43 is screwed down so that it tightly holds fan tip 41 on boss 59, there is a space between the rear edge of side wall 99 and hexagonal flange 53 on body 39.

Notice also that boss 59 on body 39 is longer than the depth of the internal cylindrical surface of cylindrical body 63 of fan tip 41, with the result that when retainer 43 is fully screwed down on fan tip 41, there will remain a space 107 between the flange 61 and surface 57 on body 39. This latter space, in connection with the former space, ensures that the tightening force of retainer 43 on fan tip 41 will be transmitted in compression between the underside of front wall 65 of fan tip 41 and the forward end of cylindrical boss 59 of body 39. Remembering that the rear surface as well as the front surface of front wall 65 is coated with low friction plastic, this force ensures that the plastic will be compressed to the point that it serves as a perfect seal, between body 39 and fan tip 41. There

is thus no possibility of liquid under pressure escaping between these two members. Thus, the fan tip 41 enjoys a self-gasketing feature, thanks to its plastic coating and thanks to the above-described relationship of the parts.

As best seen in Fig. 2, flats 109 are machines on diametrically opposite sides of retainer 43. These flats provide purchase for a tool by which retainer 43 is tightened down on fan tip 41, and also perform another function which will be described hereinafter.

The flats 109 on retainer 43 can have any orientation when the device is assembled. Specifically, there is no necessary relationship between the rotated position of flats 109, and flats 95 and 97 on tip 41, and the flats on hexagonal flange 53 of body 39.

The final piece in the assembly is the air cap 13, which comprises a cylindrical skirt or side wall 111 which is externally knurled at 113 for ease of manipulation and is internally screw threaded at 115, the diameter of the screw threading at 115 being substantially less than the internal diameter of side wall 111 to the rear of screw threading 115, for a purpose to be explained.

Air cap 13 terminates forwardly in a radially inwardly extending annular front flange 117, whose internal diameter is a little greater than the external diameter of dome 67.

In the assembled position of the parts, the internal screw threads 115 of air cap 13 are screwed down on the external screw threads 101 of retainer 43, until the inner surface of the inner portion of flange 117 of air cap 13 comes into sealing engagement with raised portions 91 and 93 on fan tip 41. For this purpose, front flange 105 of retainer 43 is of a thickness less than the height of the external cylindrical surface of cylindrical body 63 of fan tip 41, so that it is the raised portions 91 and 93 that determine the assembled position of air cap 13.

It is now time to follow the path of the compressed air, as it moves through the assemblage just described. As previously indicated, the air flows through hose 11 and head 3 to the space between cap 13 and body 39, where it moves forwardly past hexagonal flange 39 through what is indicated in Fig. 4 as a passage 119.

It will be recalled that there is another function of flats 109 on retainer 43; and this further function is to define, between flats 109 and internal screw threads 115 of air cap 13, further passages 121 communicating with and continuing the air passage 119. Then, because retainer flange 105 and air cap flange 117 are spaced apart, and because air cap flange 117 rests on raised portions 91 and 93 and so is spaced forwardly of the surfaces 87 and 89 on either side of dome 67, and isolates those surfaces from each other, there are defined further passages 123 and 125 on either side of dome 67, which extend generally radially inwardly so as to cause air to sweep therethrough and to sweep the outer surfaces of dome 67, past the flats 95 and 97, in a direction to contact the spray from opposite sides. These passages 123 and 125 thus direct what amounts to flat sheets of air in converging relationship, the theoretical plane of meeting of these sheets of air being that of the slot 77 and the axis of the device.

It is important that flats 95, 95a, 97 and 97a all be parallel to each other, so that the air flows over these flats with minimal deflection from its flow path and hence with minimal turbulence. The fact that these four flats are also parallel to the length of slot 77, ensures that the resulting air flows will not disturb the fan pattern of the sprayed material.

Not only do the flats 95a and 97a help direct the air flow from opposite sides of the spray pattern with minimal turbulence, but also they provide purchase for a tool during assembly of the device. This is a different function from the flats 109 on retainer 43: the flats 109 give purchase to a wrench or the like for tightening retainer 43 down on body 39 and fan tip 41. But the flats 95a and 97a coact with their respective tool in a somewhat different way, as follows:

It will of course be understood that spray guns according to the present invention are ordinarily hand held, and so are ordinarily used to apply liquid with a traversing movement imparted by the hand of the operator: that is, the operator will in effect "paint" with the gun, regardless of the nature of the liquid that is being dispensed. Thus, when using a fan tip, the operator will apply the sprayed liquid to the substrate, in a direction perpendicular to the length of the spray pattern, much in a manner analogous to the movements of a hand-held brush. It therefore becomes important, that the slot 77 be oriented is such a way that the operator can move the gun in what for him is an accustomed and comfortable direction, without having to twist the gun or change the direction of his movements. So it becomes important to be able to assemble fan tip 41 in a precisely rotated position relative to the rest of the gun; and the flats 95a and 97a on opposite sides of dome 67 make it possible to grasp tip 41 to hold it against rotation when retainer 43 is screwed down on tip 41.

Another embodiment of nozzle or tip according to the invention is shown in Figs. 8–10. The tip 127 shown there is characterized by a circular outlet or hole 129, in contrast to the slot 77 of the preceding embodiment. Thus tip 127 produces a circular spray pattern.

Tip 127, like tip 41, has an annular flange 131 from which rises a cylindrical body 133 that has a front wall 135 and a central dome 137. Notice, however, that there are no flats

such as 95, 95a, 97 and 97a in the preceding embodiment. There are two reasons for the omission of flats. In the first place, there is no need to provide purchase for a tool, as the rotated orientation of the tip is immaterial, thanks to circular hole 129. In the second place, there is no need to direct air in flat sheets parallel to the flat spray pattern, as in the preceding embodiment, as the spray pattern now is circular.

Indeed, in the case of a circular spray pattern, it is preferable that the air converge on the spray as evenly as possible from all sides; and to this end, there are provided several forwardly extending lugs 139 on the outer periphery of the forward annular surface 141 of wall 135 that surrounds dome 137. Lugs 139 contact the inner surface of front flange 117 when cap 13 is screwed down tight, and thus serve to perform the function of raised portions 91 and 93 in the preceding embodiment, namely, of preserving an air passageway to the outer surface of the dome. In this case, however, that air passageway completely surrounds the dome, thereby to ensure substantially uniform air flow along the outer surface of the dome toward the axis of the dome from all directions.

As before, dome 137 has an outer spherical surface 143 and an inner semi-spherical surface 145, whose centroids are arranged as before, so as to cause the dome wall to taper to a least thickness at its apex. In the case of a circular hole 129, this permits making the edges of the hole as thin as desired to the extent of providing almost a feather edge to hole 129 if desired, without sacrificing dome strength. In general, the thinner the edge of the outlet orifice, the less is the area on which encrustations of hardened reactive material can build up, and so the less is the impairment of the regularity of the spray pattern from this cause.

Tip 127, like tip 41, is of metal such as steel coated with low-friction plastic such as polytetrafluoroethylene.

In both embodiments of nozzle described above, further novel and unobvious advantages are imparted to the device by the low friction plastic coating on the outside of the dome, in combination with the air streams that blow over it. In the first place, the friction imposed by the dome on the airstreams is reduced, and this reduces turbulence of those airstreams, which in turn promotes regularity of the spray pattern. Also, on the outside of the dome, the plastic reduces the adhesion of particles of liquid that may blow back from the sprayed surface, and thereby enables the airstreams to clean the dome.

It will be seen from the foregoing disclosure, accordingly, that there are four principal areas of novel and unobvious subject matter of the present invention, as follows:

1. The plastic coating on the inside and outside of the tip 41 or 127. This coating has the following advantages:

a. It reduces the friction imposed by the tip on the liquid and thereby improves the regularity of the spray pattern and reduces fingering.

b. In combination with the cylindrical boss 59 of the body 39, which is longer than the depth of the larger cylindrical recess in the tip, the plastic coating serves as a self-gasket.

c. On the outer side of the dome, the plastic reduces the friction imposed by the dome on the airstreams and thus reduces turbulence of those airstreams, which in turn promotes regularity of the spray pattern.

d. Also on the outside of the dome, the plastic reduces the adhesion of particles of liquid that may blow back, and thereby enables the airstreams to clean the dome.

2. In the case of fan tip 41, by simple machining operations on each side of the dome, three flats are ground which are perpendicular to each other. One of these flats is perpendicular to the axis of the tip while the other two are parallel to that axis and to the slot, and one of them impinges on the dome. These perpendicular surfaces not only provide access for the air from both sides, but also, in the case of the radially outermost flats, provide purchase for a tool during assembly, and so perform a unique dual function.

3. The centers of the spherical sectors defining the inner and outer surfaces of the dome, do not coincide. Instead, the center of the inner surface is forward of the center of the outer surface. As a result, the thickness of the dome decreases toward its apex in a regular fashion, which not only reduces the area of the side walls of the outlet orifice and improves the regularity of the sprayed pattern, but also makes possible an easily performed and easily reproducible machining operation for achieving this end.

4. The flats 109 that are ground on retainer 43 provide not only passages for air but also purchase for the tool that tightens the retainer and so perform another unique dual function.

From a consideration of the foregoing disclosure, therefore, it will be evident that all of the intially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with a preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention, as defined by the appended claims.

CLAIMS

1. A nozzle for a spray gun, comprising a dome having an outlet orifice that extends

through the dome, the nozzle being of metal and having a coating of low friction plastic on the inside and on the outside of the dome and on the edges of the orifice.

2. A nozzle as claimed in claim 1, having an annular front wall that extends radially outwardly from the rear edge of the dome, the rear surface of the front wall being coated with said plastic, a hollow body to the rear of the nozzle on which said nozzle is detachably supported, and a retainer that forces said nozzle axially rearwardly against said body whereby said plastic on the rear surface of said front wall acts as a seal between said body and said nozzle.

3. A nozzle as claimed in claim 1, and means to direct air in converging streams along the outer surface of said dome, said streams converging in the spray direction.

4. A nozzle as claimed in claim 3, said outlet orifice being an elongated slot that extends equal distances on opposite sides of the axis of the dome, and flats on opposite sides of said dome that chordally intersect said dome, said flats being parallel to the axis of the dome and parallel to said slot, said airstreams converging in a plane that includes said axis and said slot.

5. A nozzle as claimed in claim 3, said outlet orifice being circular and coaxial with the dome, an annular front wall that extends radially outwardly from the rear edge of the dome, forwardly extending lugs on the periphery of said annular front wall, said means to direct air comprising an air cap having a radially inwardly extending annular flange that surrounds the dome in spaced relationship, the inner surface of said air cap flange abutting said lugs.

6. A nozzle as claimed in claim 3, said means to direct air including an air cap having a radially inwardly extending annular flange that surrounds said dome in spaced relationship, said nozzle having a radially outwardly extending flange about the rear edge of said dome, said outlet orifice being an elongated slot that extends equal distances on opposite sides of the axis of the dome, said nozzle flange having raised portions at opposite sides of said dome between said flats and endwise beyond said slot, the inner surface of said air cap flange abutting said raised portions.

7. A nozzle as claimed in claim 1, and a body against which the rear of the nozzle bears, a retainer that bears against a forwardly facing surface of the nozzle and screw threadedly engages with the body to hold the nozzle on the body, and an air cap that defines first air passageways to direct air in streams that converge on the axis of the dome, said retainer having external screw threads on which the air cap is screw threadedly received, the retainer having a plurality of portions of its external screw threads removed to provide purchase for a tool for tightening the retainer on the body and also to provide second air passageways between the retainer and the air cap that communicate with said first air passageways.

8. A nozzle as claimed in claim 7, said removed portions of said threads comprising a pair of diametrically opposed flats on the retainer parallel to each other and to the axis of the retainer.

9. A nozzle as claimed in claim 1, the dome having an inside diameter that is substantially greater than the thickness of the material of the dome, the dome having a spherical convex outer surface and a spherical concave inner surface, said outer surface having a larger radius of curvature than said inner surface, the centroid of said outer surface being disposed to the rear of the centroid of said inner surface along the axis of the dome, and said inside diameter being equal to the diameter of said spherical concave inner surface, whereby the thickness of the material of the dome progressively decreases toward the apex of the dome.

10. A nozzle for a spray gun substantially as herein described with reference to Figs. 1 to 7 or Figs. 8 to 10 of the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1982.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.